DOCUMENT RESUME

ED 246 380 CG 017 622

AUTHOR Shaughnessy, Michael F.
TITLE Cognition and Rationality.
PUB DATE Apr 84
NOTE 29p.; Paper presented at the Annual Convention of the Rocky Mountain Psychological Association (Las Vegas, NV, April 25-28, 1984).
PUB TYPE Information Analyses (070) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Clinical Psychology; *Cognitive Processes; Counseling Theories; Developmental Psychology; *Logical Thinking; Rational Emotive Therapy; Risk
IDENTIFIERS *Rationality

ABSTRACT

This paper reviews the main research in the area of human reasoning and rational thinking to determine if man is either an "innately inefficient thinking machine" or if man's irrationality is "rooted in basic human nature," as Ellis (1976) suggests. The paper focuses on the work of two English theorists, Wason and Johnson-Laird, and two American psychologists, Tversky and Kahneman. Emphasis is placed on implications for improving the ability to think and reason in a rational and logical fashion. A number of experiments are reviewed, dealing with decision making, problem solving, psychotherapy, creativity, risk, prediction, generalization, and rational emotive therapy. Some general conclusions are drawn, suggesting that most people tend to think simplistically, to make choices without considering all the variables and all of the information, and to ignore long term goals. (JAC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED246380

Paper Presented at the
Rocky Mountain Psychological Association
Las Vegas, Nevada
April, 1984

COGNITION AND RATIONALITY

MICHAEL F. SHAUGHNESSY

Psychology Department
Eastern New Mexico University
Portales, New Mexico

CG 017622

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Michael F. Shaughnessy

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Abstract

Cognition has become an important, widely researched topic in various fields of psychology in the past two decades. In addition, cognition and reasoning in particular has been an extremely germane topic in developmental and clinical psychology. The research regarding human reasoning and rational thinking processes is reviewed in terms of examining man's cognitive potential and reasoning abilities. Major theorists and theories are reviewed with an emphasis on implications for improving the ability to think and reason in a rational and logical fashion.

Cognition has become one of the major areas of study in psychology, replacing behaviorism and operant conditioning. Journals specialize in cognitive processes, theorists formulate ideas of information processing, and psychotherapeutic systems utilize cognitive processes to hasten client change. Without a doubt, cognition has become the main topic of concern and research during the eighties.

The beginning of this movement can be traced tangentially to the fifties when Ellis (1962) began to note the importance of self-statements in client change and the maintenance of self-defeating behaviors. He postulated that the casue of all emotional disturbance was irrational thinking and insisted that psychotherapeutic change depended upon the therapist's discovery of the irrational beliefs, statements, attitudes and philosophies, and helping the client to adopt more rational cognitions thus affecting behavioral change.

Ellis was thus the forerunner of other cognitively oriented therapists and undoubtedly influenced many others, at least in the field of psychotherapy. Since then many other therapeutic systems have adopted Ellis' ideas. Lazarus (1976) in his "broad spectrum" approach to therapy and his later formulation of Multimodal therapy has emphasized the examination of cognitive structures. Beck (1976) has also emphasized the importance of cognition, specifically in the treatment of depression. The work of Meichenbaum (1974) brought cognition and cognitive therapy to the attention of the psychotherapeutic community and based his system on several research models which he had utilized (1973, 1974, 1977). Mahoney (1974, 1976) has utilized cognitive methods for weight loss, the treatment of smoking behavior and other problem areas.

The importance of cognition in creativity has been emphasized by Shaughnessy (1980) while Di Guiseppe (1975) utilized behavior modification to establish rational self-statements in children. Much of this work has been based on the work of Luria (1966) and Vygotsky (1962), two famous Soviet psychologists.

Recently, Ellis (1976) suggested that irrationality may be biologically based, and that irrationality roots itself in basic human nature. There has been much research evidence in the area of reasoning and rationality, although not all of this research has been oriented toward emotional and psychological health. It would appear to be reasonable to assume that much of the research has aspects which are generalizable to other facets of the human cognitive process.

This paper will attempt to review the main research in this area in an attempt to ascertain if the experimental research and the experimental results lend any credence to the notion that man is either an "innately inefficient thinking machine" (in that without formal training man has difficulty thinking rationally in an independent manner) or that man's irrationality is "rooted in basic human nature" (as Ellis suggests).

This paper will focus on the work of two English theorists, Wason and Johnson-Laird, and two American psychologists, Tversky and Kahneman. Other more relevant specific issues will be included where applicable. From this review it is hoped that the issue of man's basic irrationality and lack of thinking processes will be clarified. Thus, it is hoped that the examples given from the research cited will prove to be illuminating regarding some of man's basic thinking and reasoning processes and problem solving skills. It is also hoped that research examples will serve to clarify the relevant

issues regarding the potential of man for independent thought. The work of Tversky and Kahneman will be reviewed initially as most Americans in the field may be familiar with their work.

Tversky (1967) initially investigated utility theory (a theory about decision making under risk) and found that the subjects involved "were willing to sell their positive gambles for their subjective expected monetary value, but they were willing to pay more than that value to rid themselves of the negative gambles." A positive gamble in this experiment was composed of two sets: one set had all 4 x 4 combinations of winning $.30, $.60, $.90 and $1.20, based on .2, .4, .6, and .8 probabilities. A second set contained all 5 x 5 combinations of .1, .3, .5, .7, and .9 probabilities of winning $.15, $.45, $.75, $1.05 and $1.35. The other two sets contained the same values, but these could be lost. Slides were projected and subjects were asked to write down the smallest amount of money for which they would be able to sell their right for each gamble (on a ten slot wheel of fortune) and for the negative value they were asked to write down the largest amount that they would be willing to pay to avoid playing the gamble. This study of decision making under risk contained two basic constructs: utility and subjective probability--the former reflects the desirability of the outcomes, the latter reflects the perceived likelihood of the events. The manner in which they are combined and their relationship to objective value and probability were examined. Thus, the subjects exhibited the commonly found tendency to overestimate the low objective probabilities and to overestimate the high ones. It was noted that the scales for this experiment were similar to an earlier experiment (Tversky, 1967) which included both risky and riskless options.

A type of "neurotic" example is offered: "If the low (objective) probability of winning a sweepstake or of losing property by theft, are grossly overestimated, then one would be willing to pay in excess of expected value to purchase a sweepstake ticket or an insurance policy." The emotional factors are not explicitly discussed in this study, the reader may, of course, infer these, particularly in light of Rational Emotive Theory (Ellis, 1976).

In a different realm, Tversky and Kahneman (1971) stated at a meeting of mathematical psychologists, and at a general session of the American Psychological Association, that the typical respondent in their studies attaches "excessive significance to inferences from relatively small samples." Other research lends credence to their statement (1972) that "for anyone who would wish to view man as a reasonable, intuitive statistician, such results are discouraging" (Cohen, 1981, p. 317). Peterson and Beach (1968) have indicated that "perhaps intuition and typical statistical usage are divergent; statisticians are seldom interested in variances relevant to means, but people may be" (p. 31). They further indicate that "variables that influence the behavior of statistical man also influence subject's behavior, but to a lesser degree." This effect may be summarized by their statement that "subjects are only partially sensitive to the relevant variables." However, as has been noted by Piaget and his collaborators, once a child has learned a function such as conservation, he/she knows that the amount of substance or weight remains unchanged even though the form may change. Principles such as this are seen to be normative in that they "lead to correct principles and predictions of future events where alternative notions would lead to error."

Thus, once the child has learned conservation, the relevant variables are no longer operative. In other words, the child knows that the amount remains the same even though the shape or form may change. In this instance the shape and form could be seen as relevant or really extraneous variables.

Tversky (1972) has viewed choice behavior as a probabilitistic process. He indicates that "it seems people are reluctant to accept the principle that (even very important) decisions should depend on computations based on subjective estimates of likelihoods or values in which the decision maker himself has only limited confidence."

Furthermore, "when faced with an important decision people appear to search for an analysis of the situation and a compelling principle of choice without relying on estimation of interval weights or on numeric computations."

The above, based on experimental analysis, leads on to concur with a non-thinking or non-mathematical nature of man. Two factors may be functional in this analysis. One is that the subject may never have been taught, trained, or utilized any of the mathematical formulations for problem solving. On the other hand, the subject may be uncomfortable utilizing a mathematical model to resolve what may be perceived as a personal decision.

Kahneman and Tversky (1973) further examined two classes of prediction: category and numerical. Predictions were seen to be following a judgmental heuristic, that is, representativeness. By utilizing this heuristic, people will predict the outcome that appears most representative of the evidence.

In addition, they investigated regression and found that graduate students could not "recognize an instance of regression when it was not

couched in familiar terms." They further incorporated operant psychology in their discussion of a 'saddening aspect of the human condition'. "We normally reinforce others when their behavior is good and punish them when their behavior is bad. By regression alone, therefore, they are most likely to improve after being punished and most likely to deteriorate after being rewarded. Consequently, we are most exposed to a lifetime schedule in which we are most often rewarded for punishing others and punished for rewarding." A further heuristic for judging frequency and probability was noted to be availability (Tversky and Kahneman, 1973). A typical experiment to explain this follows:

"Study 4: Permutations

Consider the two structures a, and b, which are shown below:

The subjects were asked: 'A path in a structure is a line that connects an element in the top row to an element in the bottom row and passes through one and only one element in each row. In which of the two

structures are there more paths? How many paths do you think there are in each structure?'"

The subjects indicated that they saw more paths in A than B-46 of 54 ($p < .001$, by sign test). The median estimates were 40 paths in A and 18 in B. In point of fact, the number of paths is the same in both structures, for 8^3; $2^9 = 512$. The authors summarize the reasons people saw more paths in A than in B in terms of availability.

"This result reflects the differential availability of paths in the two structures. There are several factors that make the paths in A more available than those in B. First, the most immediately available paths are the columns of the structures. There are 8 in column A and only 2 in column B.

Second, among the paths that cross columns, those of A are generally more distinctive and less confusable than those in B. Two paths in A share, on the average, about 1/8th of their elements, whereas the two paths in B share, on the average, half of their elements. Finally, the paths in A are shorter and hence easier to visualize than those in B."

In this 1973 study several other mathematical problems are given and it was found that systematic biases frequently occurred. Later work on diagnostic fallacies revealed that people would also draw conclusions irrationally regarding diagnostic reasoning (1977). Several experiments were conducted to show what Tversky and Kahneman later summarized to be "major underestimation of the impact of diagnostic evidence." A typical experiment follows to exemplify: "Consider the following hypotheses concerning the causes of death:

i) The chance of death from heart failure is 5% among males.
ii) The chance of death from heart failure is 10% among males who are heavy smokers.
iii) The chance of death from heart failure is 45% among males with congenital high blood pressure.

Question: What is the probability that Dick will die of heart failure?"

The subject is told that Dick is a heavy smoker with congenital high blood pressure. This experiment was designed to test whether subjects would

recognize that the correct figure was one that was higher than 45%, in order to reflect the incremental figure (force) of two independent pieces of evidence. This experiment, along with others, led Tversky and Kahneman to conclude that "the subject's major underestimation of the impact...could have severe consequences in the intuitive assessment of legal, medical or scientific evidence".

A final area investigated by Tversky and Kahneman (1981) is the framing of decisions relative to the making of choices. A decision problem is defined "by the set of options or acts among which one must choose, the possible outcomes or consequences of these acts and the contingencies or conditional probabilities that relate outcomes to acts." As in their other studies, subjects are given problems such as the one below and asked to make a decision.

"Problem 1 (N=152) Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimate of the consequences of the program are as follows:

If Program A is adopted, 200 people will be saved. If Program B is adopted, there is a 1/3 probability that 600 people will be saved and 2/3 probability that no one will be saved. Which of these two programs do you favor?"

The majority in this study chose Program A (72%) while only 28% chose Program B. Thus, the majority choice is risk aversive: The prospect of saving two hundred lives is more attractive than a risky prospect of equal expected value, that is a one in three chance of saving 600 lives.

According to the authors, "a rational decision maker will prefer the prospect that offers the highest utility." To state this more simply: The "displeasure associated with losing a sum of money is generally greater than the pleasure associated with winning the same amount." Thus, humans appear

to avoid pain more than they seek pleasure. Thus, negative reinforcement may be more reinforcing than positive reinforcement of the same nature.

The framing of "options or acts" appears to be an important factor in decision making. This problem exemplifies this area:

"Problem 3 (N=150) Imagine that you face the following pair of concurrent decisions. First, examine both decisions then indicate the options that you prefer.

Decision 1) Choose between:

a) A sure gain of $240 (Subject response = 84%)
b) 25% chance to gain $1000 and 75% chance to gain nothing (Subject response = 16%)

Decision 2) Choose between:

c) A sure loss of $750 (Subject response = 13%)
d) 75% chance to lose $1000 and 25% chance to lose nothing (Subject response = 87%)

Most chose the risk aversive choice--a riskless prospect is preferred to a risky prospect of equal or greater expected value. In the following example Tversky and Kahneman show the reversals of preference caused by variation in the framing of acts, contingencies, and outcomes.

In this problem, the choice by most is risk taking: A risky prospect is preferred to a riskless prospect of equal expected value.

Problem 4 (N=86) Choose between:

A & D 25% chance to win $240 and
75% chance to lose $760

B & C 25% chance to win $250 and
75% chance to lose $750.

In the latter, when the prospects were combined, the dominance of the second option became obvious, all chose the second option (100%) Tversky and Kahneman suggest that "the respondents apparently failed to entertain the possibility that the conjunction of two seemingly reasonable choices could

lead to an untenable result. The respondents in Problem 3 failed to combine options, although the integration was relatively simple and encouraged by instructions."

A final domain to be considered is the certainty effect and the pseudo-certainty effect. Very simply but problematically:

"Which of the following options do you prefer?

a) A sure win of $30 (78% responded to this option)
b) An 80% chance to win $45 (22% responded here)"

The authors have observed the certainty effects in problems ranging from vacation trips to the loss of life and have found that "in the negative domain, certainty exaggerates the aversiveness of losses that are certain relative to the losses that are merely probable."

TVERSKY AND KAHNEMAN RELATIVE TO RATIONAL EMOTIVE THEORY

The majority of Tversky and Kahneman's studies relate to decision making and choice. They include, however, aspects of human nature relative to rationality and cognition. These are 1) the aversiveness and avoidance of pain and negative outcomes, and 2) an unawareness of alternatives (in terms of frames) and a failure to recognize solutions when couched in unfamiliar terms.

Tversky and Kahneman (1981) suggest that "these observations do not imply that preference reversals or other errors of choice or judgment are necessarily irrational." In this vein, Simon (1958) has discussed intellectual limitations and under the "bounded rationality" aegis, subsumes the practice of acting on the most readily available frame can sometimes be justified by reference to the mental effort required to explore alternative frames and avoid potential inconsistencies."

Tversky and Kahneman suggest that the "predictive orientation encourages the decision maker to focus on future experience and to ask "What will I feel then?" rather than "What do I want now?" This is certainly in congruence with Ellis' conception of long and short term goals and self interest of the individual. However, as stated by Tversky and Kahneman, they offer no "guidance on how to resolve inconsistencies" for the decision maker, whereas Ellis offers a system of disputing one's irrational beliefs.

Certainly, Tversky and Kahneman are versed in formal logic and reasoning in a very different vein. The question is one of generalization. That is, how relevant are the problems that are posed to the subject and how much are these problems applicable to one's everyday emotional choices and decisions? Most people do not have their options stated in percentages and in probability statements. The thinking processes, may, however, be similar. In addition, similar heuristics may be at work as in the prediction of "er" and "re" words in the English language. One study investigated subjects' ability to recall such words, and inasmuch as one is more familiar with words that begin with "re", instead of words that end in "er", more "re" words were recalled. However, in terms of information processing, one can see that "re" words require only one step when "er" words require two steps. Inasmuch as certain words are more operative, they may be called upon more frequently for utilization. Perhaps this is the same for problem solving strategies and rational thinking processes.

Cohen (1981) tends to view such tests as simply "tests of the subject's intelligence or education". At this point, one would have to discriminate between logical thought and intelligence. Certainly many of Tversky and Kahneman's tests do test for generally higher order levels of mathematical

thinking, e.g. the comparison between 8 x 7 x 6 x 5 x 4 x 3 x 2 x 1 as compared to 1 x 2 x 3 x 4 x 5 x 6 x 7 x 8. If questioned as to which equation would yield the greater sum, higher order education would certainly lead to a more "rational" or logical response in view of the fact that a person trained in higher math would be able to ascertain that there was a factorial design inherent in the first equation. Therefore, one would have to question as Cohen has done whether or not these tasks are really testing higher order mathematical knowledge or rational and logical thinking. Furthermore, if the person has received this higher order mathematical training and yet errs, perhaps as has been shown in many other statistical studies that this person is simply not applying his/her knowledge, or perhaps cannot generalize from one domain to another. Regression is often seen as a loss of height from father to son, or gain if the father is shorter than average, but couched in different terms, the regression phenomena is often not recognized. Thus, generality is also to be questioned and should be seen as a major factor in this type of research.

Case (1978) has noted that "the amount of information to be dealt with at one time and the total amount of information to be dealt with are not the same thing." Therefore, in several problems, the subject has to deal with an amount of information that may be beyond his/her processing capacity. Therefore, one could question whether these problems are really measuring rationality and logic. In several experiments, the subjects have to deal with two or three sets of information, thus producing perhaps an "overload", so that the person reverts to guessing or other forms of problem solving and thinking. In addition, this reflects upon our educational system which has been teaching at the lower levels of Bloom's taxonomy and has been negligent

in not teaching how to integrate and synthesize information. Thus, a person may be able to process information at Bloom's lower levels, but not at his higher levels, either due to faulty instruction or training or simply to poor cognitive ability.

In terms of RET, the typical client may be overwhelmed with a morass of variables, his information processing system may be over-loaded and he/she may need assistance in dealing with the amount of variables about them. Problem solving skills may be weak, and the client may lack a systematic approach for dealing with choices and decisions. The client may need assistance in formulating hypotheses about the world and repercussions of his/her actions. Clients may have a poor problem solving style, or may lack experience in coping with problems in a logical systematic fashion. As Ellis has pointed out in his many books, articles and workshops--people just don't think!

If this were only an American problem, the analysis may be different. However, several English researchers have found strikingly similar results. These experiments will be dealt with in the following section.

THE ENGLISH RESEARCH EVIDENCE IN COGNITION

The most well-known researchers in this area of thinking, reasoning and cognition are Wason and Johnson-Laird. Wason's initial studies into reasoning were concerned with the study of negation (Wason, 1959, 1961). The original negation task follows:

"Instructions: Adjust the statement so that it agrees with the situation.

Statement - There is both $\begin{matrix}\text{yellow}\\\text{green}\end{matrix}$ in 4 and $\begin{matrix}\text{red}\\\text{black}\end{matrix}$ in 3."

A four boxed square with a circle in each box was presented. In addition, another four boxed square was presented with different directions:

"Instructions: Adjust the statement so that it conflicts with the situation.

Statement - There is not both $\begin{matrix}\text{yellow}\\\text{green}\end{matrix}$ in 4 and $\begin{matrix}\text{red}\\\text{black}\end{matrix}$ in 3."

A four boxed square contained a green circle in box 1, a red circle in box 2, a black circle in box 3 and a yellow circle in box 4.

In explaining the difficulty the university students had with this task, Wason offered two assumptions: "The first is that a semantic mismatch (lack of correspondence) between a sentence and it's reference takes an increment of time to process. The second is that a syntactic mismatch (the presence of a negative) takes a longer time to process because it depends upon the mental deletion of the negative from the sentence."

Based on later work of this nature, (Wason and Jones, 1963) a third explanation for difficulty with this type of problem emanated: "An emotional connotation, derived from association with prohibitives, may at least momentarily inhibit responses."

Interestingly enough, in light of current research on contextualism Wason (1965) has also investigated mental operations within a context.

"Consider the following:

1) 8 is even and 7 is not even.

2) 7 is not even."

One has a context and sounds natural and reasonable, whereas two, has no context and there is no apparent reason to make this type of statement and it sounds unnatural.

Greene (1970) had the "insight that the effect of negation should be investigated as an effect between two sentences, rather than between a sentence and the subject's coding of a physical state of affairs." Her hypothesis was that the "natural function of a negative is to" signal a change in meaning and it is exerting an unnatural function when it preserves meaning.

Most of Wason's early experiments were chronometric (concerned with time taken to evaluate, construct or complete negative sentences) but later studies (Johnson-Laird, 1967) requested subjects to create the context in which a negative sentence might have been uttered. Two rectangles had to be drawn so that the drawings could be matched with statements by another person. Red and blue crayons were available to construct a rectangle wherein:

"1) The left hand end of the strip is red.

2) The left hand end of the strip is not blue."

In this study, "it was predicted that there would be more blue and less red in the drawing corresponding to (2) than to (1) because in (2) blueness is both emphasized and negated. This prediction was confirmed, as 13 out of the 16 subjects conformed to it. Thus, even in a very simple task it is possible to elicit an appropriate context for a denial."

The effects of negatives have been investigated by Evans (1972) working with the fallacy of affirming the consequence (a form of inference, a

fallacy often seen in reasoning). We constructed four versions of modus tollendo tolens and modus ponens and utilized the following problem.

"If the letter is not A, then the number is 3.
The number is not 3."

The task in this study was to choose which of three possible conclusions were correct.

"The letter is 'A'.
The letter is not 'A'.
Nothing can be inferred concerning 'A'."

The most striking result with the valid references was that when the antecedent of the conditional was negated, as in the example above, a large number of subjects mistakenly assumed that no definite conclusion could be drawn. Such mistakes occurred in 61% of the inferences as opposed to 17% of the inferences with unnegated antecedents.

Wason and Johnson-Laird (1972) indicate that the most parsimonious explanation for difficulty when a negative is denied by an affirmative, it becomes difficult to keep track of the argument, and this leads to the "double negative explanation."

Another area of exploration is what has been termed the "three term series problems" or linear syllogisms. An example is:

"Ken is taller than Bill.
Tom is shorter than Bill.
Who is tallest?"

There have been three main models for solving these types of problems. Hunter (1957) has offered the Operational model, De Soto et al (1969), the Image model and Clark (1969), the Linguistic model.

Hunter proposed a model about the process of inference in series problems. "It takes as it's starting point an idea which William James described as the fundamental principle of inference, namely that with a

linear series of the form a b c d ... any number of intermediaries may be expunged without obliging us to alter anything in what remains written' (James, 1890, p. 646). Hunter assumes that the same principle applies to relational premises provided that they lead naturally on one from the other as in:

A is larger than B
B is larger than C

Where the premises are not arranged in this natural order, certain cognitive operations have to be performed in order to bring them into it. First, a premise may have to be converted and second, premises may have to be re-ordered. Wason and Johnson-Laird have made flow charts available for those to follow the processing of the information in a computer model.

De Soto, London, Handel (1965) suggest that the crucial step is the combination of the interpretations of premises into a unitary representation; consisting of horizontal or vertical arrays in which items are listed in their appropriate position.

The most recent approach is the psycholinguistic theory developed by Clark (1969). He suggests that there are three psycholinguistic principles functioning: lexical marking, the primacy of fundamental relations and congruency. Clark sees the process of deduction as similar to the process of comprehension. These studies of models of processing may provide insight as to the functioning of cognition relative to the solving of rational problems and logical thinking procedures.

In addition to research about inferences, Wason and Johnson-Laird are also well-known for their hypothesis testing research. In this experiment, four cards are placed in front of the subject with the following symbols: E K 4 7. The subject is aware that each of these cards has a letter on one

side and a number on the other, and the following rule is presented: If a card has a vowel on one side, then it has an even number on the other. The subject must turn over those cards and only these cards which need to be turned over in order to determine whether the rule is true or false. The vast majority of subjects say either E and 4 or only E.

Both answers are wrong. The correct answer is E and 7. The subjects tend to make two errors: They fail to choose the not q card which could falsify the rule and they do not select the q card which could not falsify it. In other words, the rule is in the form of a conditional statement "if p then q, where p corresponds to the card showing E, not p corresponds to K, q corresponds to 4 and not q to 7."

A more realistic, concrete experiment follows: "Subjects are to imagine they were Post Office Workers engaged in sorting letters. Their task was to discover whether or not the following rule had been violated:

"If a letter is sealed, then it has a 5 cent stamp on it. Instead of four cards the material consisted of four envelopes arranged as follows: the back of a sealed envelope (p), the back of an unsealed envelope (not p), the front of an envelope with an address and a 5 cent stamp on it (p), and the front of an envelope with an address and a four cent stamp on it (not q)."

The instructions were to "select just those letters that you definitely need to turn over to find out whether or not they violate the rule." In the abstract control condition the rule was: "If a letter has a D on one side, then it has a 5 on the other side and the material consisted of the front of an envelope with a D on it (p), the front of an envelope with a C on it

(not p), the back of an envelope with a 5 on it (q) and the back of an envelope with a 4 on it (not q).

Twenty four subjects were tested under both conditions in a counterbalanced order. Under the concrete conditions 21 subjects were correct (selected p and not q) and under the abstract only 2 were correct. What was found to be interesting is that there was no transfer whatsoever between the concrete and the abstract conditions: Getting the solution correct with the concrete material led to no improvement when the task was presented in abstract form subsequently.

Thus, the "nature of the material would seem to be decisive in terms of whether the subjects exercise rational thought." This may of course relate to Piagetian thinking and the authors answer by saying that "one answer would be that formal operational thought is less general than Piaget supposes, and that it may be specific to a wide variety of tasks in which a causal and a logical analysis coincide." Also, it was argued that perhaps the novelty of the problem when presented in abstract terms, may induce a temporary regression to earlier modes of cognitive functioning.

In another similar study, Wason (1966) gave subjects sets of numbers and requested that the subject generate rules regarding the numbers. A few sets of numbers follow: 12,24,36; 3,6,9; 2,6,10; 3,10,17; 1,5,9; 1,3,13; 1,4,9; and 0,3,6.

Several experiments led Wason to conclude "that in an abstract task, most people are unable to use the procedure of negative proof (proving their hypothesis wrong). It would appear to be a "totally alien concept." In the middle of one of these experiments, when the subjects were told of the

veridicality of their hypotheses, one subject developed psychotic symptoms and had to be removed by ambulance.

Inhelder and Matalon (1960) indicate that "logical errors have been studied frequently enough in the adult...in each of these cases the assumption is that the subject (a normal adult) possesses the logical necessary instruments and the aim of the research is to study the factors that prevent these instruments from functioning and which thus result in false reasoning."

The above statement implies an essentially rationalistic view of man--that man is inherently rational, but that some extraneous factors or variables prevent his/her thinking rationally. In most of the research covered so far, there has been little, if any, attempt to isolate variables or factors that prevent rationality from functioning.

THE ENGLISH SCHOOL IN RELATION TO RATIONAL EMOTIVE THEORY

The research in this area also seems to indicate that man has a good deal of difficulty in dealing with problems and problematically stated sentences either of a mathematical or prose nature. The "English" school however, has formulated several information processing models as guides for possible teaching paradigms for future instruction.

In terms of emotionality, Wason and Johnson-Laird are quite specific:

"It has been claimed that such attitudes or even prejudices distort the reasoning process. However, we know of no study which demonstrates this unequivocally" (Wason and Johnson-Laird, 1972).

Ellis, however, has indicated in his many books that factors such as demandingness, whining, and the "shoulds, oughts, and musts" do have a great

deal to do with thinking and emotional disturbances, and probably affect thinking processes.

In another area, that of language, Wason and Johnson-Laird show further that other processes contribute to rationalistic thinking difficulty. They quote Bar-Hillel (1969) and indicate that she "has pointed out that it is one of the greatest scandals of human existence that logicians have been so little interested in arguments of natural language." Ellis (1976) has indicated that much emotional disturbance stems from language--again, one's "shoulds, oughts, and musts" and the overall inclusiveness and over-generalizations that people include in their language in their daily lives.

Content was seen as crucial in many experiments and they suggest that "any general theory of human reasoning must include an important semantic component" (Wason and Johnson-Laird, 1972). Ellis has indicated that emotional disturbance stems from what the client says to himself/herself and the manner in which they say it internally (Ellis, 1976). It has also been shown that a person's logical performance may be either improved or limited by several performance factors and variables such as context, content, abstract as opposed to concrete presentations and the linguistic statement regarding the problem. However, rational emotive theory emphasizes a learning process. It is postulated that irrational is learned and must be unlearned--in differing contexts, so as to generalize.

In terms of mental illness, Wason and Johnson-Laird (1972) do not discuss the work of Ellis, but they do discuss the work of Sullivan (1962), Arieti, (1955) and Freud (1925) in his essay on negation.

In the aforementioned works, the cognitive process is seen as crucial to the therapeutic process and an understanding of the thinking process of

the schizophrenic is essential. Even with normals and neurotics, Lazarus (1981) has noted the following cognitive errors: overgeneralization, dichotomous reasoning, perfectionism, categorical imperatives, cannot versus will not, catastrophizing, non-sequitors, misplaced attributions, insisting on fairness, jumping to conlusions seeking the right answer and excessive approval seeking."

All of the aforementioned could be seen as part of Rational Emotive Theory and as highly emphasized by Ellis.

Both the research and the mental health crisis in America seems to indicate that the thinking processes may be influenced by either poor educative background or by illogical thinking. The thinking errors shown in the Wason and Johnson-Laird studies relate directly to Ellis' theory, that is, that human disturbance may be cognitively bound. Haphazard guessing, failing to examine problems from different perspectives (such as rejecting the hypothesis instead of trying to prove it), and overgeneralizing without examining, all appear to be part and parcel of what Ellis has indicated is at the heart of emotional disturbance.

Whether one can generalize from experimental studies to reality has been discussed by Cohen (1981). However, the overwhelming amount of evidence appears to show that graduate students, college students and people in general tend to think simplistically, and make choices without considering all of the variables and all of the information. They tend to ignore long-range goals in favor of short-term hedonism as has been indicated by Ellis (1977, 1976). Certainly no formal conclusions can be drawn from this small comparative study of the literature. However, future researchers may want to examine the individual types of cognitive processes

and show these are translated into problem situations in the classroom and real life situations. Indicators of neuroticism may be utilized in conjunction with problems and tests that have been reviewed in order to ascertain correlationships, if any, between the two measures. In closing perhaps it is not necessary to conduct extensive research into this area, but simply to examine the state of the world today to ascertain the rationality or irrationality of man.

References

Arieti, Silvano. Interpretation of Schizophrenia. New York: Brunner, 1955.

Beck, Aaron T. Cognitive therapy and the emotional disorders. New York International Universities Press, 1976.

Ellis, Albert. The biological basis of human irrationality. Journal of Individual Psychology, 1976, 32(2), 145-168.

Ellis, Albert. Reason and emotion in psychotherapy. New York: Lyle Stuart, Inc., 1962.

Di Guiseppe, R. The use of behavioral modification to establish rational self-statements in children. Rational Living, 1975, 10(2), 18-20.

Inhelder, B. & Matalon, B. The study of problem solving and thinking in Mussen, P. H. (Ed.) Handbook of Research Methods in Child Development, 1960.

James, William. The principles of psychology (Vol. 2). New York: Holt, 1890.

Kahneman D. & Tversky, A. On the psychology of prediction. Psychological Review, 1973, 80, 237-251.

Lazarus, Arnold. Multimodal behavior therapy. New York: Springer Publishing Co., 1976.

Lazarus, Arnold. The practice of multimodal therapy. New York: McGraw-Hill, 1981.

Luria, Aleksandr Romanovich. Higher cortical functions in man. New York: Basic Books, Consultants Bureau, 1966.

Mahoney, M. J. Personal science: A cognitive learning therapy. In A. Ellis and R. Grieger (Eds.), Handbook of Rational Emotive Therapy. New

Ellis and R. Grieger (Eds.), Handbook of Rational Emotive Therapy. New York: Springer Publishing Co., 1977.

Mahoney, M. J. Cognition and behavior modification. Cambridge, MS: Ballinger, 1974.

Meichenbaum, D. H. Cognitive behavior modification. Morristown, NJ: General Learning Press, 1974.

Peterson, C. R. & Beach, L. R. Man as an intuitive statistician. Psychological Bulletin, 1967, 68(1), 47-58.

Shaughnessy, M. Creativity and cognition. Gifted Child and Adult Quarterly, 1980, 5(4), 242-250.

Shaughnessy, M. The creative therapist. Gifted Child and Adult Quarterly. 1981, 6(2), 85-92.

Sullivan, H. S. Schizophrenia as a human process. New York: Norton, 1962.

Tversky, A. Utility theory and additive analysis of risky choices. Journal of Experimental Psychology, 1967, 75(1), 27-36.

Tversky, A. & Kahneman, D. The belief in the law of small numbers. Psychological Bulletin, 1971, 76, 105-110.

Tversky, A. Elimination by aspects: A theory of choice. Psychological Review, 1972, 79(4), 281-299.

Tversky, A. & Kahneman, D. Availability: A heuristic for judging frequency and probability. Cognitive Psychology, 1973, 5, 207-232.

Tversky, A. & Kahneman, D. Causal thinking in judgment under uncertainty. In R. Butts and J. Hintikka (Eds.), Basic problems in methodology and linguistics. Dordrecht: Reidel, 1977.

Tversky, A. & Kahneman, D. The framing of decisions and the psychology of choice. Science, 1981, 211, 453-458.

Vygotsky, L. Thought and Language. New York: Wiley, 1962.

Wason, P. C. The processing of positive and negative information. Quarterly Journal of Experimental Psychology, 1959, 11, 92-107.

Wason, P. C. On the failure to eliminate hypotheses in a conceptual task. Quarterly Journal of Experimental Psychology, 1960, 12, 129-140.

Wason, P. C. On the failure to eliminate hypotheses...--a second look. In P. C. Wason and P. N. Johnson-Laird, Thinking and Reasoning. Harmondsworth: Penguin, 1968.

Wason, P. C. & Johnson-Laird, P. N. Psychology of Reasoning: Structure and Content. Cambridge, MS: Harvard University Press, 1972.